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Champia patula (Champiaceae, Rhodymeniales), a new red algal species from the Perth region, Western Australia

John M. Huisman[1] and Gary W. Saunders[2]

[1]Western Australian Herbarium, Biodiversity and Conservation Science,
Department of Biodiversity, Conservation and Attractions,
Locked Bag 104, Bentley Delivery Centre, Western Australia 6983
[2]Centre for Environmental & Molecular Algal Research, Department of Biology,
University of New Brunswick, Fredericton, New Brunswick, Canada E3B 5A3
[1]Corresponding author, email: John.Huisman@dbca.wa.gov.au

SHORT COMMUNICATION

Champia Desvaux is a relatively well-demarcated genus in the family Champiaceae (Rhodymeniales). Its distinctive morphology includes hollow branches that are segmented by one-cell thick internal diaphragms, often with slight constrictions at the level of the diaphragms, giving the thallus a worm-like appearance. Aside from the diaphragms, the only other internal structures in the vegetative thalli are longitudinal filaments that bear lateral vesicular cells. Depending on the species, the longitudinal filaments can be distributed through the internal cavity or be restricted to the periphery, in which case they line the inner surface of the cortex.

Approximately 40 species are known, separated morphologically by habit (size, branching pattern, presence/absence of hooked branch tips, presence/absence of a stipe, degree of branch compression, presence/absence of secondary attachments) and internal features (distribution of longitudinal filaments, number of longitudinal filament cells between diaphragms, structure of cortex). Reproductive structures are generally similar, although the shape of cystocarps has been used to distinguish species. In most species tetrasporangia are intercalary in origin; however, terminal tetrasporangia have been reported for two non-Australian species, namely *C. harveyana* D.L.Ballantine & C.Lozada-Troche and *C. puertoricensis* Lozada-Troche & D.L.Ballantine from the Caribbean Sea (Ballantine & Lozada-Troche 2008; Lozada-Troche & Ballantine 2010).

Champia is common in Australia and is known primarily through the publications of Reedman and Womersley (1976), Millar (1990, 1998), Womersley (1996) and Huisman (2000, 2018). Our goal has been to use DNA barcoding [COI-5P (Saunders 2005; Griffith *et al.* 2017)] to demarcate species-level groups in Australian *Champia*, and to then assign these groups to established species based on matches with barcodes obtained from type, type locality, or verifiable specimens. Where no matches are evident, the species are compared morphologically with taxa for which no molecular data are available and, if appropriate, described as new to science. The present paper describes a relatively common species collected from Cape Peron, south of Perth, that has previously been misidentified as *C. parvula* (C.Agardh) Harv. or *C. zostericola* (Harv.) Reedman & Womersley, but differs from both in its COI-5P and *rbc*L sequences, as well as morphologically in its smaller dimensions.

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Champia patula Huisman & G.W.Saunders, *sp. nov.*

Type: Cape Peron, Western Australia, 12 March 2017, *J.M. Huisman s.n.* [GWS038895] (*holo*: PERTH 08937389).

Thallus forming a sprawling clump on intertidal and shallow subtidal rock, or epiphytic, spreading to 9 cm broad. Branching irregular, laterals arising from adjacent to diaphragms, often opposite or in whorls of up to four. Branches with occasional hooked apices. Axes terete, to 700–950 µm diam., segmented, segments L:B *c.* 1, with slight constrictions at the diaphragms in mature axes. Longitudinal filaments restricted to the periphery, with one complete cell (rarely two) and two half cells per segment. Cells of longitudinal filaments (8–)15–19(–25) µm diam. Vesicular cells borne one per longitudinal filament cell, lateral, projecting into central cavity, spherical to pyriform, 17–24 µm diam. Cortex with a single layer of large cells, these forming occasional smaller cells in the interstices between cells. Tetrasporangia forming in the mature cortex in all regions except immediately adjacent to diaphragms, pyriform, 90–100 µm diam., 120–130 µm long, tetrahedrally divided, intercalary. Other reproduction not observed. (Figure 1)

Diagnostic features. *Champia patula* may be distinguished from other members of the genus by the following combination of morphological characters: a sprawling thallus; slender axes (less than 1 mm diam.); and the occasional occurrence of lateral branches in opposite pairs. It is also characterised by unique COI-5P (GWS038894, MK505481; GWS038895, MK505482) and *rbc*L (GWS038894, MK505472) barcode sequences (Saunders, unpublished).

Other specimens examined. WESTERN AUSTRALIA: Long Bay, Cape Peron, on intertidal rock, 20 Feb. 2017, *A. Leonhardt, C. Paskov, J. Kaye, A. McCleary & T. Puskic s.n.* (PERTH); Cape Peron, 20 Feb. 2017, *J.M. Huisman s.n.* (PERTH 08921849; GWS038894); Cape Peron, 30 Dec. 2017, *J.M. Huisman s.n.* (PERTH).

Phenology. Plants have been collected from mid-summer to early autumn. Only tetrasporic thalli are known.

Distribution. Currently only reliably known from the Cape Peron type locality.

Conservation status. *Champia patula* is locally common and the type locality is within waters managed by the Department of Biodiversity, Conservation and Attractions. There appear to be no imminent threats to the species.

Etymology. The epithet is from the Latin *patulus* (spread, outspread) and refers to the sprawling habit of this species (Figure 1A).

Vernacular name. Sprawling Rainbow Weed.

Affinities. The habit and dimensions of *C. patula* are similar to those of *C. parvula* var. *amphibolis* Reedman & Womersley, but the former has peripheral longitudinal filaments with one (rarely two) complete cells and two half cells per segment, whereas the latter usually has two complete cells. In that respect, *C. patula* agrees with *C. zostericola* although is a much smaller plant. Molecular analyses indicate that *C. patula* differs from all species for which sequences are available, including *C. zostericola*, *C. parvula* and *C. parvula* var. *amphibolis*. In combined *rbc*L and COI-5P molecular

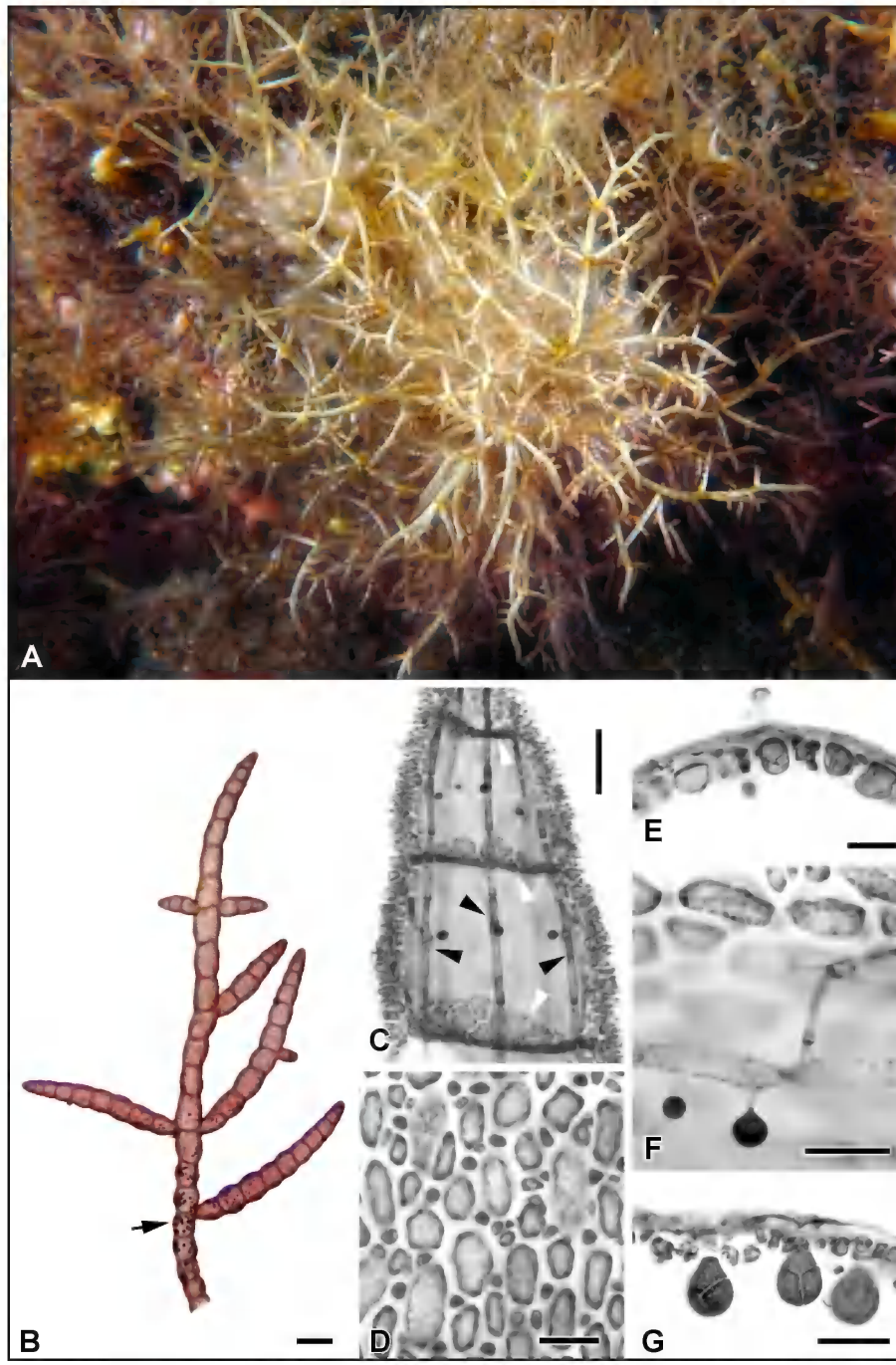

Figure 1. *Champia patula*. A – alga *in situ* at Cape Peron, showing the spreading habit; B – branch detail, showing the segmented axes. Dark spots (arrow) are tetrasporangia; C – partial longitudinal section, showing internal diaphragms (white arrowheads) and peripheral longitudinal filaments (black arrowheads); D – surface view of cortex; E – transverse section showing a single layered cortex; F – peripheral longitudinal filament with a lateral vesicular cell; G – pyriform, tetrahedrally divided tetrasporangia on the inner cortex. Scale bars = 1 mm (B); 100 µm (C, G); 50 µm (D, E, F). Images from PERTH 08937389. Photographs by J.M. Huisman.

analyses, *C. patula* forms a clade with eight other Australian genetic groups, including several undescribed species from Lord Howe Island (New South Wales), South Australia and Western Australia, plus *C. viridis* C.Agardh and *C. affinis* Hook.f. & Harv. From *C. viridis* it differs in lacking central longitudinal filaments, and from *C. affinis* in both its smaller branch diameters (<1 mm vs to 3.5 mm) and essentially single-layered cortex (multi-layered in *C. affinis*). Sequence data have been generated from 27 other *Champia* specimens from south-western Western Australia, which resolved as twelve genetic groups (Saunders, unpublished), and considerable work remains for this genus in this region.

Notes. A specimen collected by W.H. Harvey from King George Sound (TCD 0015218), labelled '57. bis' [again] in Harvey's hand, is available on *Global Plants* and appears identical to the Cape Peron material. This number is from Harvey's Travelling Set and other specimens under the same number from King George Sound and Rottnest Island were referred to *C. parvula* by Harvey (1855). Reedman and Womersley (1976) subsequently suggested that these mostly represent *C. zostericola*; however, our molecular results indicate that *C. zostericola* is a complex comprising several genetic groups (Saunders, unpublished). *Champia patula* adds to a growing list of species segregated from *C. parvula*, a species previously considered cosmopolitan in cold-temperate to tropical seas (Ballantine & Lozada-Troche 2008; Lozada-Troche & Ballantine 2010; Griffith *et al.* 2017; Schneider *et al.* 2018).

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